CLAIMS

1. A system for controlling power to light emitting diodes in signaling apparatus, said system comprising:

a plurality of light emitting diodes;

a plurality of current sources for supplying current to each of said light emitting diodes with a separate current source associated with each of said plurality of light emitting diodes;

a data processor with a bus for receiving and sending data, said data processor in communication with said current sources for controlling the amount of current supplied by each current source;

a plurality of resistors in series between the plurality of current sources and the plurality of light emitting diodes; and

a first analog-to-digital converter for determining the voltage potential at each of said plurality of resistors and for providing a digital representation of each determined voltage potential to said data processor;

said data processor using the digital representations of each determined voltage potential to control the amount of current supplied by each current source to its associated light emitting diode.

2. The system as defined in accordance with claim 1 further comprising:

a second analog-to-digital converter for determining the voltage potential of each of said plurality of light emitting diodes and for providing a digital representation of the voltage potential at each light emitting diode to said data processor;

said data processor using the digital representation of the voltage potential at each light emitting diode to determine the junction temperature of each light emitting diode to control the amount of current supplied by each current source to its associated light emitting diode to control the junction temperature thereof.

3. The system as defined in accordance with claim 2 wherein said data processor determines the junction temperature of each light emitting diode by determining the difference between the actual forward bias voltage and the normal forward bias voltage at a known temperature and by applying a coefficient of temperature related to the forward bias voltage of the light emitting diodes to said difference in forward bias voltages.

4. The system as defined in accordance with claim 1 further comprising:

a pulse-width modulator coupled to a source of power and to said plurality of current sources, said pulse-width modulator in communication with said data processor to control the amount of power supplied to the plurality of current sources.

5. The system as defined in accordance with claim 1 further comprising:

an energy storage and limiter circuit for receiving and storing input power and for supplying power to said data processor in the absence of normal input power.

6. The system as defined in accordance with claim 1 further comprising:

a vital disconnect for disconnecting the system from the source to emulate an open circuit.

7. The system as defined in accordance with claim 1 further comprising:

a vital load circuit to emulate the load drawn by an incandescent lamp.

8. The system as defined in accordance with claim 7 wherein the vital load circuit draws sufficient current to satisfy hot filament tests.

9. The system as defined in accordance with claim 1 wherein said data processor controls said plurality of current sources to provide a plurality of different current levels to each light emitting diode and said data processor compares the digital representations of the voltage received from said second analog-to-digital converter corresponding to each of said plurality of different current levels to a diode voltage-current characteristic stored in memory of the data processor.

10. The system as defined in accordance with claim 9 wherein said data processor sequentially tests each light emitting diode by sequentially controlling the plurality of current sources to provide the plurality of different current levels to each light emitting diode.

11. The system as defined in accordance with claim 9 wherein the testing of each light emitting diode is performed sufficiently rapidly to avoid the human perception of a loss of illumination from the light emitting diodes.

12. The system as defined in accordance with claim 9 wherein said data processor causes the system to be vitally disconnected from the source if it is determined that a predetermined number of light emitting diodes do not pass the test of comparing the voltages at the light emitting diodes to the stored diode voltage-current characteristic.

13. A method for controlling power to light emitting diodes in signaling apparatus, said signaling apparatus including a plurality of light emitting diodes, a plurality of current sources, a separate current source associated with each of said plurality of light emitting diodes, a plurality of resistors in series between the plurality of current sources and the plurality of light emitting diodes, said method comprising the steps of:

supplying current to the plurality of light emitting diodes with the plurality of current sources;

controlling the amount of current supplied to each light emitting diode by each current source;

determining the voltage potential at each of said resistors;

providing a digital representation of the voltage potential at each of said resistors; and

using the digital representations of each determined voltage potential to control the amount of current supplied by each current source to its associated light emitting diode.

14. The method as defined in accordance with claim 13 further comprising the steps of:

determining the voltage potential of each of said plurality of light emitting diodes;

providing a digital representation of the voltage potential at each light emitting diode;

using the digital representation of the voltage potential at each light emitting diode to determine the junction temperature of each light emitting diode; and

controlling the amount of current supplied by each current source to its associated light emitting diode based upon the determined junction temperature.

15. The method as defined in accordance with claim 14 further comprising the steps of:

determining the difference between the actual forward bias voltage and the normal forward bias voltage at a known temperature for each light emitting diode; and

applying a coefficient of temperature related to the forward bias voltage of the light emitting diodes to said difference in forward bias voltages to determine the junction temperature of each light emitting diode.

16. The method as defined in accordance with claim 13 further comprising the step of:

pulse-width modulating the power supplied to said plurality of current sources to control the amount of current supplied by the plurality of current sources to the plurality of light emitting diodes.

17. The method as defined in accordance with claim 13 further comprising the step of:

receiving and storing input power for said data processor; and

supplying power to said data processor from the stored input power in the absence of normal input power.

18. The method as defined in accordance with claim 13 further comprising the step of:

vitally disconnecting the signaling apparatus from the source to emulate an open circuit.

19. The method as defined in accordance with claim 13 further comprising the step of:

using a vital load circuit to emulate the load drawn by an incandescent lamp.

20. The method as defined in accordance with claim 19 further comprising the step of:

using the vital load circuit to draw sufficient current to satisfy hot filament tests.

21. The method as defined in accordance with claim 13 further comprising the steps of:

controlling said plurality of current sources to provide a plurality of different current levels to each light emitting diode; and

comparing the digital representations of the voltage corresponding to each of said plurality of different current levels to a stored diode voltage-current characteristic.

22. The method as defined in accordance with claim 21 further comprising the step of:

sequentially testing each light emitting diode by sequentially controlling the plurality of current sources to provide the plurality of different current levels to each light emitting diode.

23. The method as defined in accordance with claim 21 further comprising the step of:

testing each light emitting diode sufficiently rapidly to avoid the human perception of a loss of illumination from the light emitting diodes.

24. The method as defined in accordance with claim 21 further comprising the step of:

vitally disconnecting the signaling apparatus from the source if it is determined that a predetermined number of light emitting diodes do not pass the test of comparing the voltages at the light emitting diodes to the stored diode voltage-current characteristic.